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## ABSTRACT

The relationship between processing style (either auditory or visual) and sentence and imagery strategies was investigated with a sample of 80 second-grade children. Assignment to auditory- and visual-processor groups was based on subjects' recall of 16 pictograph sequences, four of which included visual interference and four of which included auditory interference. An alternate processing task was also administered. Auditory and visual processors were then divided into four groups: imagery strategy, sentence strategy, combination strategy, and control. In the imagery condition, the child was shown a "cartoon" slide of what the pictograph sequence meant and was instructed to imagine a similar cartoon for each subsequent sequence. The sentence strategy group was instructed to read the pictures as if they were a sentence. The combined strategy group was instructed to read the pictographs as if they were a sentence and to imagine a cartoon of what they meant. Finally, the control group was told to try hard to remember the pictures. The number of articles correctly inserted and the verb inflections used both while reading the sequences and during recall were recorded as direct measures of strategy use. The sentence strategy was effective for both groups, while the imagery strategy was effective for auditory processors only. (The usefulness of an organizational strategy for semantic integration is discussed.)  
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Imagery as a Facilitator  
of Semantic Integration

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### Abstract

The relationship between processing style, either auditory or visual, and sentence and imagery strategy instructions was examined in second grade children. A pictograph sentence memory task was used so that the effects of semantic integration could be assessed without interference from decoding problems. The sentence strategy was found to be effective for both auditory and visual processors. However, the imagery strategy was only effective for the subpopulation of auditory processors. The usefulness of an organizational strategy for semantic integration is discussed.

## Imagery as a Facilitator of Semantic Integration

There has been little research examining interactions between the type of integration or elaboration strategy instruction and abilities of the learner in very young children. Even fewer studies have examined the interaction between imagery strategies and imagery ability. Studies by Delaney (1978), Levin, Divine-Hawkins, Kerst, and Guttman (1974) and Rohwer (1973) are notable exceptions. Since semantic integration abilities are critical as children are beginning their school careers and learning how to read, it is important to investigate for which children imagery will be an effective semantic integration strategy.

In 1982, Weed and Ryan investigated interactions between the effectiveness of two semantic integration strategies and processing style characteristics of the learner. In general, results indicated that first and second graders who tended to process information auditorily benefitted equally from an imagery and a sentence integration strategy. However, for those children who tended to process information visually, performance rose following instructions on the sentence strategy only. No improvement occurred with imagery instructions for visual processors.

The present study replicates and extends the findings of Weed and Ryan (1982) by illuminating processes involved in the facilitative effects of the imagery and sentence strategies and

by providing further support for the effectiveness of semantic integration to increase recall. Semantic integration was investigated using a pictograph sentence memory task. Pictographs are simple line drawings each representing a word (see Figure 1). 35 pictographs representing nouns, verbs, adjectives and prepositions were used. Although pictographs representing nouns were most iconic, the other pictographs were as illustrative of the word as possible. For example, the pictograph verb 'give' appears to be one person giving a box to another person, and the pictograph for red is actually a red circle. Articles and verb inflections were intentionally omitted from the pictograph sentences in order to assess their spontaneous occurrence. Therefore, before strategy instructions were given, the pictograph sentence in Figure 1 would be read as 'boy give red flower to horse'. Each pictograph sequence was presented on a back projector screen.

The pictograph sentence memory task was employed for three reasons. First, Denner (1970) and Ferguson (1975) have found that the ability to integrate pictographs is related to beginning reading ability. Second, the task is appropriate for beginning readers and pre-readers. Although the ability to use imagery instructions has been investigated in written prose tasks, these tasks are not appropriate for younger children due to their limited reading vocabulary. Third, if children are processing the pictographs as sentences, it is difficult to orally recall the sequence without inserting articles and verb inflections. Thus, analyzing the percentage of articles and

verb inflections used correctly provides a direct measure of strategy use.

Since Richardson, in 1978, suggested that visual or auditory coding may be more related to strategy effectiveness than imagery or verbal ability, at least in adults, Weed and Ryan (1982) assessed both coding or processing style as well as imagery and verbal ability. Processing style, rather than imagery or verbal ability, was found to be related to strategy effectiveness. Consequently, only processing style was assessed in the present study.

In order to classify children as auditory or visual processors the interference paradigm of Brown-Peterson was employed. Following initial presentation of the pictograph sentences, children received either auditory interference or visual interference. During auditory interference children were required to actively attend to a sequence of numbers played from a prerecorded tape by repeating aloud the number four when it occurred. Similarly, during visual interference a series of letters was presented visually to which the children had to actively attend by touching the number four wherever it appeared. Children who recalled less following auditory interference trials than following visual interference trials were classed as auditory processors, and children recalling less following visual interference trials as visual processors. In other words, if the children were trying to remember the pictographs using some form of semantic rehearsal then responding orally to the numbers should interfere with ongoing

processing resulting in decreased recall. In contrast, if the children were trying to remember the pictographs using a visual style, responding orally should not impair processing, whereas attending visually should. Approximately 2/3 of the children were classed as auditory processors and 1/3 as visual processors. It is interesting to note that this is the exact proportion of auditory to visual processors obtained by Weed and Ryan (1982). Auditory and visual processors did not differ significantly on pictograph sentence recall prior to training.

The present study examined four specific hypotheses.

1. The interaction between imagery and sentence strategy instructions and auditory and visual processing style was investigated in order to replicate the findings obtained by Weed and Ryan (1982).

2. A strategy including both imaginal and auditory components was included to further elucidate processes involved in strategy utilization. If the trained strategy is compensating for processes lacking in auditory and visual processors, for example, by providing semantic organization to a visual processor, then the inclusion of both components in the combined strategy should not further enhance recall. Alternatively, the visual component could in some way interfere with visual strategies already being employed by visual processors. In this case, the combination strategy should result in lowered performance for visual processors than the sentence only strategy.

3. A more stringent measure of the effectiveness of the strategies for increasing semantic integration versus straight memory was included. Weed and Ryan (1982) found that children in both the sentence and imagery strategy condition recalled more than the control or practice only group. Although it was clear that the strategy instructions were responsible for improved recall, the reason for this increase was not explicitly tested. In the present study a random version of the pictograph sentence memory task was added which contained the same pictographs as the sentence version; however, the order was meaningless. For example 'give flower horse red to boy'. Since use of the trained strategies should not be an effective means to facilitate integration with random sequences, performance improvements were only expected on meaningful sequences following training. However, if the strategies were improving straight memory, increases should be seen on both meaningful and random sequences.

4. The validity of the interference paradigm to classify children as auditory or visual processors was assessed by employing an alternate method of assesement.

#### Method

80 second graders participated in the study, 42 boys and 38 girls. Their mean age was 7 years, 8 months. A 4 (strategy) x 2 (processing style) between subjects design was used to assess the effects of the imagery, sentence and combination strategies on pictograph sentence recall for



auditory and visual processors. Each child was tested individually during three sessions.

During the first session, children were given 16 pictograph sequences to recall: four sentences with no interference, 4 random sequences with no interference, 4 sentences with auditory interference and 4 with visual interference. Assignment to auditory and visual processor groups was based on recall with the interference trials as previously described.

During the second session, an alternate processing style task was administered to all children. This task differed from the pictograph sentence memory task in three ways. First, the to-be-remembered items were all simple drawings of nouns, rather than nouns, verbs, prepositions and adjectives. Second, items were presented sequentially rather than simultaneously. Third, each line drawing was presented on a separate file card, rather than on the back projector screen. Interference was presented in the same manner as during the first session. This second test was used as an alternative assessment of auditory and visual processing style, but was not used to classify children.

Before the third session, auditory and visual processors were divided into four groups - imagery, sentence and combination strategy conditions and a practice control group. Children in the three experimental groups were briefly taught to integrate the pictographs in order to remember them better. In the imagery condition the child was shown a 'cartoon' slide

of what the pictograph sequence meant, and was instructed to imagine a similar cartoon for each subsequent sequence in order to remember the pictures better (see Figure 2). The sentence strategy group was instructed to read the pictures like a sentence inserting the articles and appropriate verb inflections as a means of remembering the pictures better. The combined strategy group was instructed to both read the pictographs like a sentence and to imagine a cartoon of what it meant. The control group was instructed only to try hard to remember the pictures. The number of articles correctly inserted and verb inflections used both while reading the sequences and during recall were recorded as direct measures of strategy use.

#### Results and conclusions

Results of a two way, 4 (condition) x 2 (processing style), analysis of variance indicated that children in the combination and sentence conditions recalled significantly more sentence pictographs than children in the imagery condition, who were superior to the control children. Although the interaction between condition and processing style was not significant, the means for the imagery conditions were in the same direction as in Weed and Ryan (1982), indicating that imagery does work somewhat better for auditory processors.

Planned comparisons between the four experimental groups, conducted separately for auditory and visual processors, indicated that only for auditory processors did the imagery strategy significantly improve performance over that of the

control group. The imagery component in the combination condition did not significantly increase performance for either the visual or auditory processors over the sentence condition (see Table 1). These results partially support the hypothesis that the trained sentence or imagery strategy compensates for semantic or visual abilities that the child fails to use.

To provide further insight into processes used by auditory and visual processors to remember the pictograph sentences, direct measures of strategy use were analyzed. Total strategy use was assessed by summing the four standardized indices of strategy use: number of articles and verb inflections inserted while reading the sequences and number of articles and verb inflections inserted during recall. This total strategy measure accounted for 24 percent of the variance in post-test scores for children in the sentence and combination strategy conditions. Total strategy use was further subjected to a 2 (condition) x 2 (processing style) analysis of variance. The imagery and control conditions were excluded from the analysis due to the near zero level of articles and verb inflections included. Although the results were not significant the means indicate that the combination strategy was somewhat facilitative for auditory processors and somewhat detrimental for visual processors (see Table 2). This interpretation is only speculation due to the insignificance of the analysis, however. Further research should examine the relationship between strategy use and processing style with a larger sample.

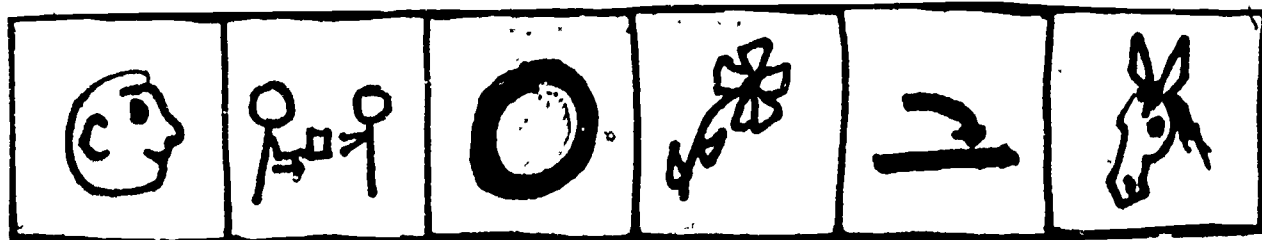
Support for the hypothesis that increases in recall following strategy training are due to semantic integration is provided by comparisons of the four groups on the random pictograph task following training. Results of a three-way, condition x processing style x trial (pre or post), analysis of variance indicated that there were no significant group or trial main effects nor any significant interactions. Since no differences between experimental and control groups existed on the random pictograph task following training, although the experimental groups did perform significantly better than the control on the meaningful sequences, the hypothesis that the improved recall of the strategy trained groups was due to semantic integration was confirmed.

The two alternate methods of assessing processing style were significantly correlated; however, the relationship was not strong,  $r=.24$ . Since the two tasks were qualitatively different it is impossible to infer if the low correlation was due to unstable processing style or just reflects the different processing requirements of the two tasks.

In conclusion, although the results of the present study did not fully replicate Weed and Ryan (1982), they do support the proposition that an imagery strategy is more effective for auditory processors. Further, although the combined strategy was slightly better for both auditory and visual processors it was not significantly different from the sentence only strategy. The value of an organizational strategy for promoting semantic integration was confirmed.

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(The) boy      give(s)      (the) red      flower      to      (the) horse.

FIGURE 1

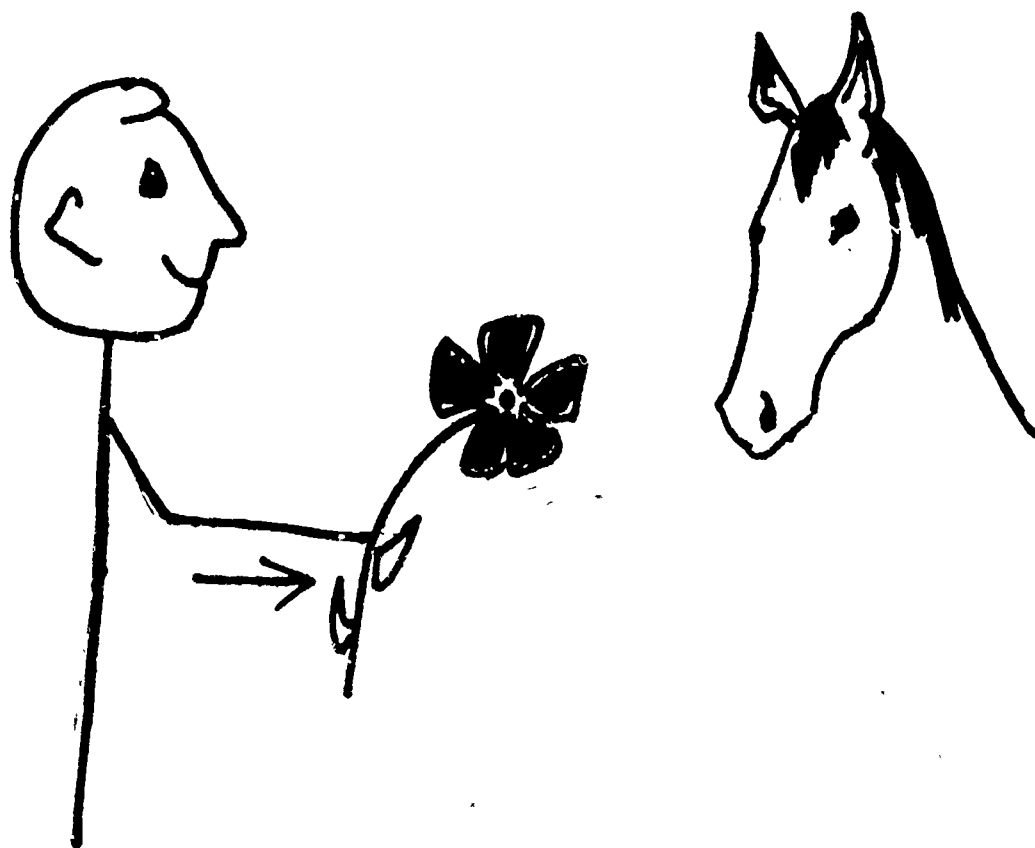


Table 1

Mean Percentage Recall  
For Pictograph Sentences  
(N=10)

	Control	Imagery	Sentence	Combination
Auditory	41 <sub>a</sub>	57 <sub>b</sub>	65 <sub>bc</sub>	77 <sub>c</sub>
Visual	38 <sub>a</sub>	47 <sub>ab</sub>	61 <sub>bc</sub>	67 <sub>c</sub>

Different letters indicate groups that are significantly different

Table 2

Standardized Strategy Use Scores  
(N=10)

	Sentence	Combination
Auditory	53.8	63.7
Visual	50.7	41.0